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Research Report

University of Alberta researcher Dr. Michael Stiles

Scientists seek a better "culture"

Easing the whey for Alberta cheese

It's not a part of Alberta's agricultural economy that commands a lot of public attention, but cheese and cultured milk processing utilize up to 25% of the province's milk production. However, the making of cottage cheese, cheddar cheese, yogurt and other cheese products requires lactic starter cultures which the Alberta dairy industry currently imports from the U.S.

The imported cultures get the job done, says Michael Stiles, a professor of food science at the University of Alberta, but he believes that it is possible to develop "a local expertise in dairy starter management and development", which could lead to Alberta producing its own starter cultures and developing new techniques for maintaining and producing cultures.

With the help of a grant from Alberta Agriculture's Farming for the Future program, Dr. Stiles is now pursuing those goals. If successful, his work will mean economic gains for Alberta dairy processors, and generally serve the industry better.

Starter cultures are the catalysts in the cheesemaking process. They are sold to dairy processors in a freeze dried or frozen state. They are subsequently transferred into a growth medium (a milk substitute or modified milk) to make a bulk culture. The bulk culture is stored for five days, and over that period appropriate amounts are drawn off to inoculate various milk products in huge cheesemaking vats. The microorganisms go to work and, if all moves according to plan, produce a quality cheese.

But, in their initial studies, Dr. Stiles and his University of Alberta colleague Lech Ozimek found that five out of eleven starter cultures in use for cheesemaking in Alberta were performing poorly or questionably in the laboratory. Lactic starter organisms, says Dr. Stiles, are generally unstable and they require constant rotation in order to keep providing appropriate levels of acid. If those levels drop during the production process, the cost to producers can be great. A single 5,000-kilogram vat of milk discarded because of starter culture failure can represent a loss of as much as $16,000. "Establishing a local dairy starter expertise would reduce the chance of such losses," he says, "and it would enable starter cultures better suited to Alberta's industry to be developed."

Recent advances in the understanding of the genetics of starter culture bacteria, says Dr. Stiles, are making such improvements possible. While he is understandably cautious about letting out the secrets of his system, he is satisfied that he can develop bacteria which will remain desirably active in culture over the five-day storage period. He still has some further testing and fine tuning to do, but Dr. Stiles is confident that he and Dr. Ozimek will have good news for the Alberta dairy industry in the near future.

To line or not to line?

A new evaluation of canal seepage

The amount of water lost from irrigation canals and ditches due to seepage has been a matter of contention since the first irrigation systems were built in southern Alberta nearly a century ago. Svat Jonas, a research engineer with Alberta Agriculture, says that educated guesses through the years have pegged the losses at anywhere from 5% to 30% of all water supplied. Those estimates, of course, are too inexact to be of much use to irrigation district managers hoping to make good decisions on problems of water management. So, with the help of a grant from Alberta Agriculture's Farming for the Future program, Mr. Jonas and Nanuk Engineering of Cochrane have undertaken a study to determine the exact magnitude of seepage loss in irrigation canals, and what measures might be taken to curtail it.

The need for such research, says Mr. Jonas, is readily apparent. If a high degree of inefficiency is found in an irrigation system, then more water is being diverted from river systems than is necessary. The water might be put to better uses, whether recreational, agricultural, municipal or industrial. Moreover, if seepage is extreme, land along the ditches and canals can become unproductive due to water logging and salinity.

To examine the efficiency of existing irrigation systems, Mr. Jonas and Nanuk Engineering selected a test area of two square miles, northwest of Vauxhall. The particular site was chosen for its uniform, medium texture soil and because several different types of lining are used in its system of irrigation ditches. One portion is lined with a buried plastic membrane, another portion with concrete, and another has no lining whatsoever. "We want to know the difference in conveyance efficiency for each kind of lining," says Mr. Jonas. "So, we have to measure how much water flows into the system, and how much comes out at the end as spillage, how much the farmers use, how much is lost to evaporation, and how much is gained as precipitation. With all those variables determined, we can then figure out how much is lost to seepage."

"Our feeling is that actual seepage in medium texture soil won't be as big a factor as we thought."

By last fall, Nanuk and Mr. Jonas had compiled an abundance of data from field studies. They won't complete their evaluation of those numbers until later this summer, but Mr. Jonas has seen enough to allow him to reach some general conclusions. "Our feeling is that actual seepage in medium texture soil won't be as big a factor as we thought," he says. "I would give a very rough estimate of losses at about 5% to 12%. It's certainly not up around 30% as some people thought."

Results of this research will likely be used in many different ways. Irrigation planners and designers will use the data to generate improved and more economical designs of irrigation canals. Irrigation districts will benefit since they will need to line only selected sections of irrigation ditches. Insufficient knowledge of water losses due to seepage is, in many cases, causing over- or underestimation of rehabilitation spending. And the end user, the farmer, will benefit in terms of timely water deliveries and flexible irrigation canal systems which will not cause land degradation. In most cases the rehabilitated works will allow many unproductive acres to be brought back to full production.

Sometime in the future, Mr. Jonas would like to see this research repeated on completely different soils in order to compare results. "I would feel more comfortable with that," he says. "After all, we've only looked at a few miles out of 8,000 miles of irrigation ditches in the province." That's not to say, however, that the findings are of no use beyond the test site. Mr. Jonas and Nanuk Engineering will soon be taking their data to the University of Calgary where it will be fed into a complex computer model that should be able to extrapolate the findings with reasonable accuracy over a larger geographic area.

Research en

No need for winter antifreeze

Thermal waterer makes good use of available heat

Harley Earl runs a mixed farm with a large cattle component near High River. Two years ago he wanted to move some stock onto a distant pasture, but one problem stood in his way: there was no power source to hook up the electric waterer needed to keep his well from freezing during winter months. He noticed what he hoped would be a solution to his problem advertised in a farm journal — an American-built, energy-free, thermal livestock waterer. To test whether this technology would be effective under Alberta conditions, Mr. Earl visited High River district agriculturist Allen Toly who helped him to apply for a grant from Alberta Agriculture's Farming for the Future On-Farm Demonstration Program. Mr. Earl then put the thermal waterer to work.

"Well, it's been in use for two winters now and Harley's quite happy with it," says Mr. Toly. "We haven't had any really severe weather over those winters, so it may be a bit early to pass judgement, but he's had no problems with freezing."

The thermal waterer is basically a big, strong, plastic box with holes cut into the top through which animals can drink. Although it is unpowered, the thermal waterer is designed to take advantage of higher soil temperatures below the frostline. The bottom of the waterer is attached to a 15-inch (38 cm) diameter pipe which is sunk 12 feet (3.6 meters) into the ground. The pipe acts as a 'heat well' which helps to keep the base of the waterer from freezing during cold weather. To further help retain heat, the waterer is wrapped in a thick blanket of insulation. The upward movement of water, as it is consumed, also helps to prevent freezing. And, the waterer is covered. This helps prevent energy losses due to wind; yet, it does not hamper larger animals from drinking. They need to only push down on a fairly wide floating or ball valve to get to the water.

Mr. Earl has noticed a number of advantages in using the thermal waterer. Because it requires no external power source, it can be placed anywhere.

"A waterer can take a beating from the livestock, but Harley's (thermal plastic model) is holding up well."

Constructed of a tough plastic, the thermal waterer has proven more durable than electric models made of metal. And the periodic electrical shock that occurs with the traditional waterers (and which is sometimes fatal to livestock) is not a problem with the unpowered unit.

Cost-wise, the thermal waterer has advantages. Although the initial cost of a thermal waterer is $200 to $300 higher than an electric model, the ther-

engineer Svat Jonas inspects a water measuring structure

mal model is easier to maintain and has no ongoing operating costs. However, Mr. Toly advises some caution, since the thermal waterer has yet to be tested during a severe Alberta winter. In addition, some younger animals are reported to have had difficulty depressing the top valves. This is not a problem with older, stronger animals.

Overall, "whether or not you can make up the capital cost will depend on how long the thermal model lasts," says Mr. Toly. "A waterer can take a beating from the livestock, but Harley's (thermal plastic model) is holding up well."

While he doubts the thermal waterers will make electric models obsolete overnight, Mr. Toly notes that a number of livestock producers have been enquiring about this on-farm demonstration. "There are more and more people interested," he says. "We had a horse owner in here just a while ago asking about it. He's had a problem with short circuits in his electric waterer. I think he might give the thermal one a try."

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ALBERTA AGRICULTURAL RESEARCH INSTITUTE

by Bob Bogle
Chairman of the Board

After many months of preparation, it is gratifying to write that the Alberta Agricultural Research Institute (AARI) is open for business. Indeed, the Institute has developed quite quickly. Last July our enabling legislation was passed. A month later, on August 25, our Board of Directors held its first meeting. Since then, the Board has met regularly to study and develop the Institute's by-laws, its research priorities, and two new assistance programs.

Five priority areas for research funding have been established. They are: 1. production efficiency, 2. food processing, 3. marketing, 4. management of soil and water resources, and 5. diversification.

I am also pleased to report the creation of the Matching Grants and the Research Coordination Programs. We hope both of these new funding efforts will encourage our province's successful agricultural research community to undertake even more innovative research and development.

The Matching Grants Program will essentially do what its name says. Under the program, the Institute will match, on a dollar-per-dollar basis, most contributions for approved agricultural research projects. In short, the program is designed to fund research, primarily in cooperation with the private sector.

The Research Coordination Program, on the other hand, will encourage a greater exchange of relevant information among and between researchers. Today, in agriculture, we often hear the phrase 'technology transfer'. It usually refers to the process of getting new technology (and information) from the lab to the farm, as quickly and effectively as possible. The Research Coordination Program also involves technology transfer, except, in this case, we hope to encourage its transfer from lab to lab and from researcher to researcher.

To qualify for the Matching Grants Program, researchers must have already obtained support from an eligible source. Such sources include private companies, foundations, individuals, farm groups, non-Alberta provincial agencies, and federal agencies. Note, federal funds must be 'new' dollars, which means they must not have been diverted from an existing program or funding which already applied to Alberta.

As mentioned above, the Research Coordination Program operates under a concept that is a little bit different. Strictly speaking, it is not intended to support actual research, but to encourage researcher contact. Therefore, grants are limited to a maximum of $5,000 per project per year. They cannot replace current budgets for travel or distributing information, nor can they be applied to research costs, such as manpower. Beyond this, we welcome any worthwhile idea or approach.

Although it will take several months before applications are distributed, returned and evaluated, I expect we will be able to announce awards in both programs in this fiscal year.

Anyone who wishes to obtain more information about the Matching Grants Program and the Research Coordination Program should contact: The Executive Director, Alberta Agricultural Research Institute, 3rd Floor, J.G. O'Donoghue Building, 7000 - 113 Street, Edmonton, Alberta T6H 5T6. Phone (403) 422-1072.

Mother Earth blows hot and cold

Another way to reduce the heating bill

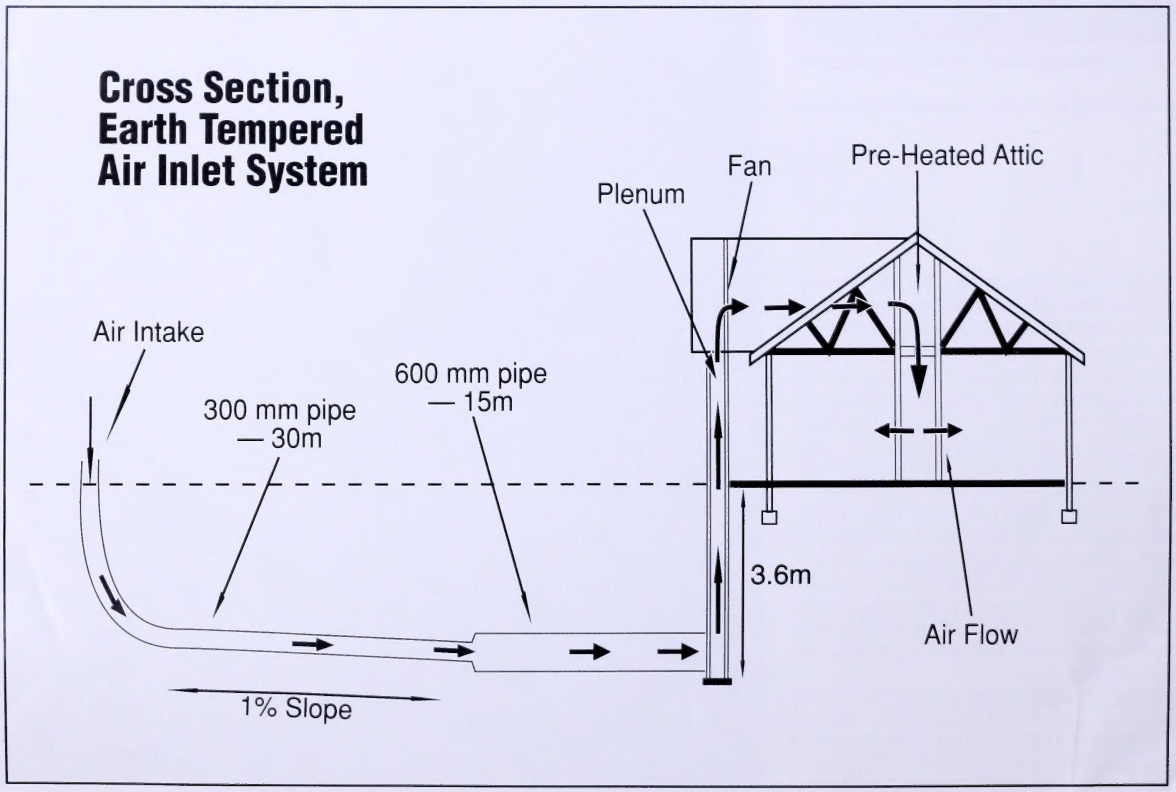
In 1986, Haynes, Alberta farmer Eugene Brown decided to expand his successful veal operation. But, to do so, he needed to increase the size of his barn, and its heating system was already taxed to capacity. He had almost resigned himself to the high cost (about $15,000) of installing a second hot-water system when he read about earth-tempered air inlet systems in a farm magazine. While an earth-tempered system would cost about the same as a second hot water heater, in the long run it would be much less expensive and easier to operate. With the help of a grant from Alberta Agriculture's Farming for the Future program and technical assistance from Robert Borg, an Alberta Agriculture regional engineer, Mr. Brown was able to test and demonstrate this technology on his farm.

An earth-tempered air inlet system takes advantage of relatively constant soil temperatures below the frost line. At depths of about 12 feet (3.6 meters), the ground temperature ranges between 2.5 degrees C in early spring to 8 degrees C in early autumn. As a result, hot summer air can be drawn from the earth's surface, passed through cool underground pipes, and then blown into a barn to maximize ventilation. And, in winter, cold air can be piped through relatively warm sub-surface soil to provide an inexpensive heating system. Mr. Brown found that by drawing air through about 150 feet (45.7 meters) of underground pipe he could warm or cool the air by as much as 15 degrees C.

The earth-tempered system is not difficult to construct. It consists of an air inlet at the earth's surface, underground pipe and an intake plenum at the barn. The pipe is buried at 12 feet, with a one-degree slope. This allows condensation to flow towards the barn where it can be drained periodically with a sump pump.

Typical air temperature modifications have been -20 degrees C winter air warmed to -2 degrees C, and 30 degrees C summer air cooled to 12 degrees C.

After building the extension to his barn, Mr. Brown poured concrete for the plenum and installed his pipes, which took about one week. Fans were installed at the top of the plenum to draw air through the system. The air flows into the barn to an insulated, preheated attic (controlled by the hot-water system), and then it is distributed throughout the building by exhaust fans. In winter, Mr. Brown still needs to heat incoming air, but his original furnace can now handle all his heating requirements because the air supply is warmer to begin with. Since January 1987, typical air temperature modifications have been -20 degrees C winter air warmed to -2 degrees C, and 30 degrees C summer air cooled to 12 degrees C, and always with an improved ventilation rate and better air quality.

In addition to being able to heat a larger area without increasing his energy requirements and with no extra maintenance needs, Mr. Brown is also saved the task of wetting down his barn floor in summer to cool the calve rooms; the earth-tempered air does this job for him. The system also appears to have had a positive affect on animal health. Mr. Brown has noticed a drop in medication costs and death losses since he installed it.

What's more, says Alberta Agriculture's Robert Borg, "the technology is easily transferred to other types of barns. For example, summer cooling will improve breeding performance in a swine breeding barn. In a swine finishing barn, the extra feed and days to finish during hot weather may be avoided due to summer air cooling."